Alice Petrov

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RESEARCH INTERESTS

I am broadly interested in the intersection of computer science and pure mathematics. I am especially interested in geometric data processing, topological data analysis, and geometric deep learning.

EDUCATION

PhD in Electrical Engineering and Computer Science Oct 2024 -
Massachusetts Institute of Technology
- Advisor: Professor Justin Solomon

MSc in Mathematics and Foundations of Computer Science Oct 2023 - Sep 2024
Magdalen College, University of Oxford
- Dissertation: Persistent Homology for the Analysis of Stratified Spaces
- Advisor: Professor Vidit Nanda

BComp in Computing, Mathematics, and Analytics Sep 2018 - April 2023
Queen's University
- Thesis: An Algebraic Model of Planning Problems
- Advisor: Professor Christian Muise

RESEARCH EXPERIENCE

Graduate Student Researcher Nov 2023 - Sept 2024
University of Oxford
Supervisor: Dr. Vidit Nanda
- Applied persistent homology to analyze stratified data, using persistent intersection homology and novel bifiltration techniques for singularity analysis
- Built computational pipelines to analyze word embeddings, revealing structural differences through topological analysis of dimensionality reduction techniques

Undergraduate Student Researcher Nov 2021 - July 2023
Queen's University, MuLab
Supervisor: Dr. Christian Muise
- Applied semigroup theory to study the representations and transformations of state spaces in AI planning problems
- Explored the application of automated planning to automated theorem proving

Undergraduate Research Assistant Jan 2020 - Jan 2021
Queen's University, RISE Lab
Supervisor: Dr. Yuan Tian
- Applied ecological network models to analyze the robustness of open source software ecosystems to the loss of contributors
- Streamlined data collection by using the Github REST API and Requests library, leveraging multiprocessing and cutting collection time by 90%

Summer Research Student May 2020 - Aug 2020
Queen's University, RISE Lab
Supervisor: Dr. Yuan Tian
- Conducted a research study on the automated classification and recommendation of reusable code snippets from open source Jupyter notebooks
- Developed and analyzed a variety of single label and multi-label classifier models using NLTK, Keras, Sklearn, and Tensorflow

PUBLICATIONS

Automated Planning Techniques for Elementary Proofs in Abstract Algebra
Alice Petrov, Christian Muise, Scheduling and Planning Applications Workshop, ICAPS (2023).

PARIS: Planning Algorithms for Reconfiguring Independent Sets
Remo Christen, Salomé Eriksson, Michael Katz, Christian Muise, Alice Petrov, Florian Pommerening, Jendrik Seipp, Silvan Sievers, David Speck, 26th European Conference on Artificial Intelligence (2023).

From State Spaces to Semigroups: Leveraging Algebraic Formalism for Automated Planning
Alice Petrov, Christian Muise (2023), Workshop on Heuristics and Search for Domain-independent Planning, ICAPS (2023).

PREPRINTS

Analyzing the Robustness of Open Source Software Ecosystems to the Loss of Contributors: A Case Study
Zhendong Sha, Alice Petrov, Yuan Tian, Ting Hu (2022).

EXPOSITORY ARTICLES

The Essence of de Rham Cohomology
Alice Petrov (2024).

Introduction to Stratified Spaces and Intersection Homology
Alice Petrov (2024).

REVIEWING

The 35th International Conference on Automated Planning and Scheduling — Nov 2025

OTHER RESEARCH ACTIVITIES

LOGML (London Geometry and Machine Learning) Summer School — Jul 2024
London, United Kingdom
- Evaluated invariant machine learning methods and applied them to detect the existence of terminal singularities in toric varieties
- Developed a permutation invariant attention-based network that required substantially less training data than previous methods

Topological Persistence in Geometry and Analysis Reading Group — Oct 2023
Oxford, United Kingdom
- Attended a weekly reading seminar with a focus on topological persistence in geometry and analysis

CoRe Challenge — Jul 2022, Jul 2023
Kingston, Canada
- Participated in the CoRe Challenge, studying the construction of graphs for the independent set reconfiguration problem

INDUSTRY EXPERIENCE

Mathematical Intern — Sep 2024 - Jun 2025
Smith Institute, Internship
- Applied mathematical modelling and machine learning to optimize the balancing of the UK National Grid
- Developed MLOps architectures for the effective deployment of data pipelines and machine learning models in practice

Software Engineer May 2021 - Aug 2022
State Street, Internship
- Developed State Street's public cloud infrastructure with a focus on logging, compliance, and internal libraries; technologies include Python, AWS Lambda, DynamoDB, SNS, Kinesis, PingFederate, REST APIs, CICD, etc.

Systems Analyst May 2019 - Aug 2019
Ontario Teachers' Pension Plan, Internship
- Conducted analytical and statistical tasks in Java, and developed strategies to optimize program reach
- Automated daily data wrangling and visualization tasks in the department, and built an efficient data pipeline continuously used after the end of the term

HONOURS & AWARDS

NSERC Postgraduate Scholarship - Doctoral Sep 2025
Natural Sciences and Engineering Research Council of Canada
Provides financial support to high-calibre students who are engaged in an eligible doctoral program in natural sciences and engineering, both within Canada and abroad.

Canada Graduate Scholarship - Doctoral (Declined) Sep 2025
Natural Sciences and Engineering Research Council of Canada
Promotes continued excellence in Canadian research by rewarding and retaining high-calibre doctoral students at Canadian institutions.

EECS Great Educators Fellowship Sep 2025
Massachusetts Institute of Technology
Recognizes great teachers of the department and provides graduate fellowships in the Department of Electrical Engineering and Computer Science (EECS).

Albert Harold Lightstone Scholarship Aug 2022
Queen's University
Awarded to the student entering the fourth year of an honours program with a major concentration in Mathematics or Statistics having the second-highest standing in the mathematics and statistics courses of the first three years and an overall average of 80 per cent or better.

First CoRe Challenge Jul 2022
4x First Place, 3x Second Place, 1x Third Place (in nine tracks) for the system *PARIS: Planning Algorithms for Reconfiguring Independent Sets* for Remo Christen, Salomé Eriksson, Michael Katz, Emil Keyder, Christian Muise, Alice Petrov, Florian Pommerening, Jendrik Seipp, Silvan Sievers, and David Speck

Nellie & Ralph Jeffery Award in Mathematics Jul 2021
Queen's University
Three or more scholarships are awarded, on the recommendation of the Department of Mathematics and Statistics, to undergraduate students majoring in Mathematics or Statistics.

Nan Skelding Scholarship Jul 2020
Queen's University
Awarded on the basis of academic excellence to female students entering third year in the Department of Mathematics and Statistics in the Faculty of Arts and Science.

Dean's Honour List with Distinction Oct 2020

Queen's University
Awarded on the basis of academic excellence to the top 3% of all students registered in the B.Sc., B.Sc. (Honours), B.Cmp., and B.Cmp.(Honours) degree programs.

Undergraduate Student Research Award May 2020
Natural Sciences and Engineering Research Council of Canada
Received a $7840 research grant from the Natural Sciences and Engineering Research Council of Canada.

Dean's Honour List x2 Oct 2019, Oct 2021
Queen's University
Awarded to students who achieve an academic year GPA of at least 3.5.

Queen's University Excellence Scholarship Sep 2018
Queen's University
Awarded on the basis of academic excellence for incoming undergraduate students at Queen's University.

COMMUNITY OUTREACH

OxWoCS (Oxford Womxn in Computer Science Society) 2024 - present
Role: Vice President of Outreach
Managing a team of five to run several outreach initiatives.
- Gender Equity in STEM Conference: Contributed to the organization and execution of GenSTEM, promoting diversity and inclusion in the STEM fields.
- GirlsWhoML: Actively organizing regular hands-on workshops to encourage those who identify as female and non-binary to pursue careers in the fields of AI and ML.
- OxWoCS Challenge Club: Organizing and leading discussions around weekly problem sheets to inspire more young women to continue their mathematical pursuits and to help them thrive as they do so.

Oxford MPLS (Mathematical, Physical and Life Sciences Division) 2024
- Royal Institution Masterclass: Developed and implemented lectures in Computer Science for Year 9 students, significantly enhancing their understanding of machine learning. Received consistently excellent feedback for these sessions.

Oxford Mathematical Institute 2024
- Oxford Maths Festival: Engaged with students and families, introducing basic programming skills through interactive Sphero robot sessions.
- Oxford Online Maths Club: Led a series of online interactive workshops aimed at advancing the mathematical skills of 6th form students.

CONFERENCES ATTENDED

The 4th annual Oxford Centre for Topological Data Analysis conference 2024
GenSTEM (Gender Equity in STEM) Conference 2024
The 33d International Conference on Automated Planning and Scheduling 2023
The 32nd International Conference on Automated Planning and Scheduling 2022

LANGUAGES

- English: Native
- Russian: Fluent
- French: Basic

HOBBIES AND INTERESTS

- Classic Literature, Philosophy, Nonfiction

Currently reading: *"Factfulness" by Hans Rosling*

- Visual Arts

  Currently painting: *Northern Canadian Landscape, Oil on Canvas*

- Avid runner, hiker, and weightlifter

REFERENCES

Dr. Vidit Nanda
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